COMBINED LICENSE APPLICATION
PLANT AP1000-1
FSAR SECTION 9.5.1, "FIRE PROTECTION SYSTEM"

The following is an example of the information that would be expected to be submitted in a COL applicant's FSAR, Section 9.5.1, "Fire Protection System". The hypothetical COL application references the Westinghouse AP1000 Design Control Document (DCD), Revision 14 The following information supplements the generic DCD with plant-specific information for the Fire Protection System and Fire Protection Program description. Program information is based, in part, on the Callaway FSAR Site Addendum, Section 9.5.1, (as a basis for the scope and level of detail) and is augmented to address the COL information items in the AP1000 DCD Section 9.5.1.8.

In general, the COL applicant would be responsible for confirming the applicability of the approved standard design information, including references, identifying any departures from the approved standard design and providing information for the site-specific design and programs. For this example, it was assumed that there are no departures from the approved design and that there is no existing operating unit at the site. Also, in this example, references are made to FSAR Appendix 9.5A, Chapter 17, and Table 9.5-2, "Compliance with Regulatory Guide 1.189." That information has not been generated for this example but should be included in an actual application. With those exceptions, the following example represents the scope of information that would be provided for Section 9.5.1 of an FSAR.

9.5.1 Fire Protection System

The information in the AP1000 DCD, Revision 14, Section 9.5.1, is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.1 Design Basis

9.5.1.1.1 Safety Design Basis

The information in the AP1000, Revision 14 DCD, Section 9.5.1.1.1, is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.1.2 Power Generation Design Basis

The information in the AP1000 DCD, Revision 14, Section 9.5.1.1.2, is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.1.3 Non-Safety Related Containment Spray Function

The information in the AP1000 DCD, Revision 14, Section 9.5.1.1.3 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.2 System Description

9.5.1.2.1 General Description

The information in the AP1000 DCD, Revision 14, Section 9.5.1.2.1 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.2.1.1 Plant Fire Prevention and Control Features

Architectural and Structural Features

The information in the AP1000 DCD, Revision 14, for Section 9.5.1.2.1.1 is applicable to the AP1000-1 Plant and is incorporated by reference without exception. Additionally, fire exit routes from all areas of the plant will be clearly marked prior to implementation of the Fire Protection Program as discussed in Section 9.5.1.9. Fire resistance test data supporting the use of composite materials as 2-hour fire barriers in stairwells will be available prior to fuel load. The data are collected as a result of testing by an independent laboratory in accordance with ASTM E-119.

Plant Arrangement

The information in the AP1000 DCD, Revision 14, for this section is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

Electrical Cable Design, Routing and Separation

The information in the AP1000 DCD, Revision 14 for this section is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

Control of Combustible Materials

The information included in this section of the AP1000 DCD, Revision 14 is applicable to the AP1000-1 Plant and is incorporated by reference. Subsection 9.5.1.9.4 of this section describes the programmatic controls for combustible materials that will be established and implemented for the fire protection program.

Control of Radioactive Materials

The information included in this section of the AP1000 DCD, Revision 14, is applicable to the AP1000-1 Plant and is incorporated by reference. Subsection

9.5.1.9.5 of this section summarizes the programmatic controls for radioactive materials in fire related emergencies that will be established and implemented for the fire protection program.

9.5.1.2.1.2 Fire Detection

The information in the AP1000 DCD, Revision 14, Section 9.5.1.2.1.2 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.2.1.3 Fire Water Supply System

The information in the AP1000 DCD, Revision 14, Section 9.5.1.2.1.3 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.2.1.4 Automatic Fire Suppression Systems

The information in the AP1000 DCD, Revision 14, Section 9.5.1.2.1.4 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.2.1.5 Manual Fire Suppression Systems

The information in the AP1000 DCD, Revision 14, Section 9.5.1.2.1.5 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.2.2 System Operation

The information in the AP1000 DCD, Revision 14, Section 9.5.1.2.2 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.2.3 Component Description

The information in the AP1000 DCD, Revision 14, Section 9.5.1.2.3 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.3 Safety Analysis (Fire Protection Analysis)

The information in the AP1000 DCD, Revision 14, Section 9.5.1.3 is applicable to the AP1000-1 Plant and is incorporated by reference. FSAR Appendix 9.5A supplements the Generic DCD with the fire protection analysis of site-specific fire areas.

9.5.1.4 Testing and Inspection

The information in the AP1000 DCD, Revision 14, Section 9.5.1.4 is applicable to the AP1000-1 Plant and is incorporated by reference. Subsection 9.5.1.9.6 provides information on testing and inspection programs for plant operation that will be established and implemented for the fire protection program.

9.5.1.5 Instrumentation Applications

The information in the AP1000 DCD, Reference 14, Section 9.5.1.5 is applicable to the AP1000-1 Plant and is incorporated by reference without exception.

9.5.1.6 Personnel Qualification and Training

The information in the AP1000 DCD, Revision 14, Section 9.5.1.6 is applicable to the AP1000-1 Plant and is incorporated by reference. Subsection 9.5.1.9.7 summarizes qualification and training programs that will be established and implemented for the fire protection program.

9.5.1.7 Quality Assurance

The information in the AP1000 DCD, Revision 14, Section 9.5.1.7 is applicable to the AP1000-1 Plant and is incorporated by reference. Chapter 17 of the FSAR describes the QA program and its application to fire protection.

9.5.1.8 Combined License Information

Section 9.5.1.8 of the AP1000 DCD identifies information to be addressed in a COL application referencing the generic DCD. The generic DCD also includes Table 9.5.1-1 that provides a point-by-point comparison of the design to the provisions of BTP CMEB 9.5-1. Items in that table identified as "WA" (will address) are left to the COL applicant to address.

Table 9.5-1 identifies where each COL information item is addressed and where each of the "WA" items in the AP1000 generic Table 9.5.1-1 is addressed.

9.5.1.9 COL Fire Protection Program Implementation

This section discusses the elements of the Fire Protection Program that are the responsibility of the COL applicant and outside the scope of the AP1000 DCD. Many of these elements will be finalized during the plant construction period. Since the application is for a COL authorizing both construction and operation, a summary description of the operations phase program procedures is included in the application. The description reflects a typical set of fire protection

procedures; actual plant procedures may be organized differently but will include the same requirements and be based on the same standards.
In accordance with BTP CMEB 9.5-1, C.1.e(1) , the fire protection program described in this section will be fully operational for buildings storing new fuel and adjacent fire areas that could affect the fuel storage area prior to receipt of new fuel. In accordance with BTP CMEB 9.5-1, C.1.e(2) , the fire protection program described in this section will be fully operational prior to initial fuel loading.

9.5.1.9.1 Fire Protection Program

The AP1000-1 Plant Fire Protection Program will be established to ensure that a fire will not prevent safe shutdown of the plant and will not endanger the health and safety of the public. Fire protection at the plant will use a defense-in-depth concept that includes fire detection, extinguishing systems and equipment, administrative controls and procedures, and trained personnel.

9.5.1.9.1.1 Fire Protection Program Criteria

The AP1000-1 Plant Fire Protection Program is based on the criteria of several industry and regulatory documents. The level of compliance with Regulatory Guide 1.189 is described in Table 9.5-2 (future). NFPA Standards No. 4, No. 4A, No. 6, No. 7, No. 8. and No. 27 were used as guidance in development of the Fire Protection Program. Any updates to the list of exceptions to the NFPA Standards will be processed by a change to this document. Table 9.5-1 provides a cross-reference to information addressing compliance with BTP CMEB 9.5-1. Note that attached Table 9.5-1 does not include items addressed in the AP1000 DCD or not applicable to the AP1000 standard design.

9.5.1.9.1.2 Responsibilities

A senior manager reporting to the Chief Nuclear Officer will be responsible for the Plant AP1000-1 Fire Protection Program. Assigning the responsibilities at that level will provide the authority to delegate responsibility and to obtain the resources and assistance necessary to meet Fire Protection Program objectives. The relationship of this manager and other personnel with fire protection responsibilities will be shown on organization charts in the appropriate procedures.

The assigned senior manager will be responsible for the following:

1) Ensuring that programs and periodic inspections are implemented to:

a) Minimize the amount of combustibles in safety-related areas
b) Determine the effectiveness of housekeeping practices
c) Assure the availability and acceptability of the following:

i) Fire Protection System and components
ii) Manual fire fighting equipment
iii) Emergency breathing apparatus
iv) Emergency lighting
v) Communication equipment
vi) Fire barriers including fire rated walls, floors and ceilings, fire rated doors, dampers, etc., fire stops and wraps, and fire retardant coatings. Procedures will specifically address the administrative controls to be put in place, including fire watches, when a fire barrier is breached for maintenance.

d) Assure prompt and effective corrective actions are taken to correct conditions adverse to fire protection and preclude their recurrence.

2) Ensuring that periodic maintenance and testing of fire protection systems, components, and manual fire fighting equipment is conducted, test results are evaluated, and the acceptability of systems under test is determined in accordance with established plant procedures.

3) Designing and selecting equipment related to Fire Protection.

4) Reviewing and evaluating proposed work activities to identify potential transient fire loads.

5) Managing the Plant Fire Brigade, including:

a) Developing, implementing and administering the Fire Brigade Training Program.
b) Scheduling and conducting fire brigade drills.
c) Critiquing fire drills to determine how well training objectives are met.
d) Performing a periodic review of the fire brigade roster and initiating changes as needed.
e) Maintaining the fire training program records for members of the fire brigade and other personnel.
f) Ensuring that sufficient fire brigade personnel are identified at the beginning of each shift.

6) Developing and conducting the Fire Extinguisher Training Program

7) Implementing a program for indoctrination of personnel gaining unescorted access to the protected area in appropriate procedures which implement the fire protection program.

8) Implementing a program for instruction of personnel on the proper handling of accidental events such as leaks or spills of flammable materials.

9) Preparing procedures to meet possible fire situations in the plant and for assuring assistance is available for fighting fires in radiological areas.

10) Implementing a program that controls and documents inoperability of fire protection systems and equipment. This program should also initiate proper notifications and compensatory actions when inoperability of any fire protection system or component is identified.

11) Developing and implementing preventive maintenance, corrective maintenance, and surveillance test fire protection procedures.

12) Ensuring plant modifications, new procedures and revisions to procedures associated with fire protection equipment and systems that have significant impact on the Fire Protection Program are reviewed by an individual who possesses the qualifications of a fire protection engineer.

9.5.1.9.2 Fire Brigade

9.5.1.9.2.1 General

The AP1000-1 Plant is designed and the Fire Brigade organized to be self sufficient with respect to fire fighting activities. The Fire Brigade is organized to deal with fires and related emergencies that could occur. It consists of a Fire Brigade Leader and a sufficient number of team members to be consistent with the equipment that must be put in service during a fire emergency.

A sufficient number of members of each shift crew receive fire brigade training and physical examinations and are therefore qualified to be fire brigade members. The assigned Fire Brigade members for any shift shall not include the Shift Supervisor and any other members of the minimum shift operating crew necessary for safe shutdown of the unit and any other personnel required for other essential functions during a fire emergency. Fire Brigade members for a shift will be designated in accordance with established procedures at the beginning of the shift.

The Fire Brigade Leader and at least two brigade members per shift shall have sufficient training in, or knowledge of, plant safety-related systems to understand the effect of fire and fire suppressants on safe shutdown capacity.

The minimum equipment provided for the AP-1000-1 Plant Fire Brigade consists of personal protective equipment such as turnout coats, boots, gloves, helmets, emergency communications equipment, portable lights, portable ventilation equipment and portable extinguishers. Self-contained breathing apparatus (SCBA) approved by NIOSH are provided for selected fire brigade, emergency repair and control room personnel. Additional SCBAs will be provided near the

personnel containment entrance for the exclusive use of the Fire Brigade. The Fire Brigade Leader will have ready access to keys for any locked fire doors.

The on-duty Shift Supervisor has responsibility for taking certain actions based on an assessment of the magnitude of the fire emergency. These actions include safely shutting down the plant, making recommendations for implementing the Emergency Plan, notification of emergency personnel and requesting assistance from off-duty personnel. Emergency Plan consideration of fire emergencies will include the guidance of Regulatory Guide 1.101.

To qualify as a member of the Fire Brigade, an individual must meet the following criteria:

1) is available to answer fire alarms,
2) has attended the required training sessions for the position he occupies on the Fire Brigade,
3) has passed an annual physical exam.

9.5.1.9.2.2 Fire Brigade Training

A training program will be established to assure that the capability to fight fires is developed and documented. The program will consist of classroom instruction supplemented with periodic classroom retraining, practice in fire fighting, and fire drills. Classroom instruction and training will be conducted by qualified individuals knowledgeable in fighting the types of fires that could occur within the plant and its environs and using on-site fire fighting equipment.

9.5.1.9.2.2.1 Classroom Instruction

Fire Brigade members receive classroom instruction in fire protection and fire fighting techniques, prior to qualifying as members of the fire brigade. This instruction will include:

1) Identification of flammable materials and substances along with their location within the plant and its environs.
2) Identification of the types of fires that could occur within the plant and its environs.
3) Identification of the location of onsite fire fighting equipment and familiarization with the layout of the plant including ingress and egress routes to each area.
4) The proper use of onsite fire fighting equipment and the correct method of fighting various types of fires.
5) Review of each individual's responsibilities under the Fire Protection Program.
6) Proper use of communication, lighting, ventilation, and emergency breathing equipment.

7) Fire Brigade Leader direction and coordination of fire fighting activities.
8) Toxic and radiological characteristics of expected combustion products.
9) Proper methods of fighting fires inside buildings and confined spaces.
10) Review of fire fighting procedures and procedure changes.
11) Review of fire protection-related plant modifications and changes in fire fighting plans.

9.5.1.9.2.2.2 Retraining

Classroom refresher training will be scheduled on an appropriate frequency to assure retention of initial training.

9.5.1.9.2.2.3 Practice

Practice sessions will be held for fire brigade members on the proper method of fighting various types of fires. These sessions will be scheduled on an appropriate frequency and will provide brigade members with experience in actual fire extinguishment and the use of emergency breathing apparatus.

9.5.1.9.2.2.4 Drills

Fire brigade drills will be conducted on an appropriate frequency. Drills will be either announced or unannounced. Training objectives will be established prior to each drill and reviewed by plant management. Drills will be critiqued on the following points:

1) Assessment of fire alarm effectiveness.
2) Assessment of time required to notify and assemble the fire brigade.
3) Assessment of the selection, placement and use of equipment.
4) Assessment of the Fire Brigade Leader's effectiveness in directing the fire fighting effort.
5) Assessment of each Fire Brigade member's knowledge of fire fighting strategy, procedures, and use of equipment.
6) Assessment of the Fire Brigade's performance as a team.

Performance deficiencies identified, based on these assessments, will be used as the basis for additional training and repeat drills.

9.5.1.9.3 Administrative Controls

Administrative controls for the Fire Protection Program are implemented through plant administrative procedures. These procedures will be available for review and inspection prior to implementation of the program. Industry publications NFPA 4, 4A, 6, 7, 8 and 27 will be used as guidance in developing those procedures.

9.5.1.9.4 Control of Combustible Materials, Hazardous Materials and Ignition Sources

The control of combustible materials at Plant AP1000-1 will be defined by administrative procedures. Those procedures will impose the following controls:

1) Prohibit the storage of combustible materials (including unused ion exchange resins) in safety-related areas or establish designated storage areas with appropriate fire protection.
2) Govern the handling of and limit transient fire loads such as flammable liquids, wood and plastic materials in buildings containing safety-related systems or equipment.
3) Assign responsibility to the appropriate supervisor for reviewing work activities to identify transient fire loads.
4) Govern the use of ignition sources by use of a flame permit system to control welding, flame cutting, brazing and soldering operations. A separate permit will be issued for each area where such work is done.
5) Minimize waste, debris, scrap, and oil spills resulting from a work activity in the safety-related area while work is in progress and remove the same upon completion of the activity or at the end of each work shift.
6) Govern periodic inspections for accumulation of combustibles and to ensure continued compliance with these administrative controls.
7) Govern the use and storage of acetylene-oxygen and other compressed gasses in safety-related areas.
8) Govern the use and storage of hazardous chemicals.

9.5.1.9.5 Control of Radioactive Materials

As discussed in the AP1000 DCD, the plant is designed with provisions for sampling of liquids that may contain radioactivity and may be drained to the environment. Plant operating procedures will require such liquids to be collected and sampled prior to discharge. Liquid discharges will be required to be below activity limits prior to discharge.

9.5.1.9.6 Testing and Inspection

Testing and inspection requirements will be imposed through administrative procedures. Maintenance or modifications to the Fire Protection System will be subject to inspection to assure conformation to design requirements. Installation of portions of the system where performance cannot be verified through preoperational tests, such as penetration seals, fire retardant coatings, cable routing, and fire barriers will be inspected. Inspections will be performed by individuals knowledgeable of fire protection design and installation requirements. Inspection and testing procedures will address the identification of items to be

tested or inspected, responsible organizations for the activity, acceptance criteria, documentation requirements and signoff requirements.

Fire Protection materials subject to degradation (such as fire stops, seals and fire retardant coatings will be visually inspected periodically to assure they are not degraded or damaged. Fire hoses will be hydrostatically tested in accordance with NFPA-1962. Hoses stored in outside hose stations will be tested annually and interior standpipe hoses will be tested every 3 years.

The Fire Protection System will be periodically tested in accordance with plant procedures. Testing will include periodic operational tests and visual verification of damper and valve positions. Fire doors and their closing and latching mechanisms will also be included in these procedures.

The preoperational testing program will include a procedure for confirming that the as-installed configuration of fire barriers matches the tested configuration. The procedure will identify the process for dispositioning deviations.

9.5.1.9.7 Personnel Qualification and Testing

A Fire Protection Engineer will be responsible for formulation and implementation of the Fire Protection Program. This individual will have completed not less than six years of engineering experience, three of which shall have been in a responsible position in charge of fire protection engineering work. This individual will report to the senior manager described in Section 9.5.1.9.1.2. Qualification and training for Fire Brigade members is discussed in Section 9.5.1.9.2.

Qualification and training of other plant personnel involved in the Fire Protection program will be governed by plant qualification procedures. These classifications include Training personnel, Maintenance personnel assigned to work on the Fire Protection system, and Operations personnel assigned to operate and perform testing.

9.5.1.9.8 Fire Doors

Fire doors separating safety-related areas will be provided with closing mechanisms and will be inspected semiannually to verify that the closing mechanisms are operable. Watertight and missile resistant doors are not provided with closing mechanisms. Fire doors with automatic closing mechanisms will be inspected daily to verify that the doorways are free of obstructions.

Fire doors separating safety related areas will normally be closed and latched. Fire doors that are locked closed will be inspected weekly to verify position. Fire

doors that are closed and latched will be inspected daily to assure that they are in the closed position. However, fire doors that are closed and electrically supervised at a continuously manned location are not inspected.

TABLE 9.5-1
COL INFORMATION ITEMS

AP1000 "COL Items" (Section 9.5.1.8, (Table 1.8-2) including "WA" Items in Table 9.5.1-1)	BTP CMEB 9.5-1 Section	Text Reference
Section 9.5.1.8 Items 9.5-1 COL applicant to address qualification requirements for individuals responsible for development of FP Program, training, admin procedures, etc.	NA	9.5.1.9.1 (12)
9.5-2 COL applicant to provide site-specific fire protection analysis information for the yard area, admin. Building, etc.	NA	FSAR Appendix 9.5A (later)
9.5-3 COL Applicant to address BTP CMEB 9.5-1 issues from Table 9.5.1-1	See Table 9.5-1 ("WA") items below	
9.5-4 COL applicant to address update of list of NFPA exceptions after design certification complete	NA	9.5.1.9.1.1
9.5-5 COL Applicant to provide analysis to demonstrate that operator actions for minimizing probability of spurious ADS actuation can be accomplished within 30 minutes of fire detection	NA	FSAR Appendix 9.5A (later)

AP1000 "COL Items" (Section 9.5.1.8, (Table 1.8-2) including "WA" Items in Table 9.5.1-1)	BTP CMEB 9.5-1 Section	Text Reference
9.5-6 COL applicant to address the process for identifying deviations between the as-built installation of fire barriers and their tested configuration.	NA	9.5.1.9.6
9.5-7 COL applicant will provide 2-hour fire resistance test data in accordance with ASTM E-119 and NFPA 251 for the composite material selected for stairwell fire barriers.	NA	9.5.1.2.1.1
9.5-8 COL applicant will establish procedures to minimize risk when fire areas are breached for maintenance. Those procedures will address the use of fire watches for fire areas breached during maintenance.	NA	9.5.1.9.1.2
Table 9.5.1-1 Items (WA) 1) Direction of FP Program; availability of personnel.	C.1.a(1)	9.5.1.9.1.2
2) Defense-in-depth concept; objective of fire protection program.	C.1.a(2)	9.5.1.9.1
3) Management responsibility for overall fire protection program; delegation of responsibility to staff.	C.1.a(3)	9.5.1.9.1.2
4) The Staff should be responsible for: a) Fire protection program requirements. b) Post-fire shutdown capability. c) Design, maintenance, surveillance, and quality assurance of fire protection features. d) Fire prevention activities. e) Fire brigade organization and training f) Prefire planning.	C.1.a(3)	9.5.1.9.1.2(12)
5) The organizational responsibilities and lines of communication pertaining to fire protection should be defined through the use of organizational charts and functional descriptions.	C.1.a(4)	9.5.1.9.1.2
6) Personnel qualification requirements for fire protection engineer, reporting to the position responsible for formulation	C.1.a(5)(a)	9.5.1.9.7

AP1000 "COL Items" (Section 9.5.1.8, (Table 1.8-2) including "WA" Items in Table 9.5.1-1)	BTP CMEB 9.5-1 Section	Text Reference
and implementation of the fire protection program.		
7) The fire brigade members' qualifications should include a physical examination for performing strenuous activity, and the training described in position C.3.d. (WA 34)	C.1.a(5)(b)	9.5.1.9.2.1
8) The personnel responsible for the maintenance and testing of fire protection systems should be qualified by training and experience for such work.	C.1.a(5)(c)	9.5.1.9.7
9) The personnel responsible for the training of the Fire Brigade should be qualified by training and experience for such work.	C.1.a(5)(d)	9.5.1.9.2.2
10) The following NFPA publications should be used for guidance to develop the FP program: No. 4, No. 4A, No. 6, No. 7, No. 8 and No. 27.	C.1.a(6)	9.5.1.9.1.1 9.5.1.9.3
11) On sites where there is an operating reactor and construction or modification of other units is underway, the superintendent of the operating plant should have the lead responsibility for sit fire protection.	C.1.a(7)	N/A
14) Fires involving facilities shared between units should be considered.	C.1.b	N/A
15) Fires due to man-made, site-related events that have a reasonable probability of occurring and affecting more than one reactor unit should be considered.	C.1.b	appendix 9.5A (later)
22) Fire protection systems should retain their original design for potential man-made, site-related events that have a reasonable probability of occurring at a specific plant site.	C.1.c(4)	Appendix 9.5A (later)
26) The fire protection program for buildings storing new reactor fuel and for	C.1.e(1)	9.5.1.9

AP1000 "COL Items" (Section 9.5.1.8, (Table 1.8-2) including "WA" Items in Table 9.5.1-1)	BTP CMEB 9.5-1 Section	Text Reference
adjacent fire areas that could affect the fuel storage area should be fully operational before fuel is received at the site.		
27) The fire protection program for an entire reactor unit should be fully operational prior to initial fuel loading in that unit.	C.1.e(2)	9.5.1.9
28) Special considerations for the fire protection program on reactor sites where there is an operating reactor and construction or modification of other units is underway.	C.1.e(3)	N/A
29) Establishing administrative controls to maintain the performance of the fire protection system and personnel.	C.2	9.5.1.9.3 9.5.1.9.2(2)
30) The guidance of RG 1.101 should be followed as applicable.	C.3.a	9.5.1.9.2.1
31) Establishing site brigade: minimum number of Fire Brigade member on each shift, qualifications of fire brigade members, competence of brigade leader.	C.3.b	9.5.1.9.2.1
32) The minimum equipment provided for the brigade should consist of turnout coats, boots, gloves, hard hats, emergency communications equipment, portable ventilation equipment, and portable extinguishers.	C.3.c	9.5.1.9.2.1
33) Recommendations for breathing apparatus for Fire Brigade, damage control, and Control Room personnel.	C.3.c	9.5.1.9.2.1
34) Recommendations for Fire Brigade training program.	C.3.d	9.5.1.9.2.1
35) Establishing quality assurance (QA) programs by applicants and contractors for the fire protection systems for safety-related areas; identification of specific criteria for quality assurance programs.	C.4	9.5.1.7 and FSAR Chapter 17
50) Fire doors should be inspected semi-	C.5.a(5)	9.5.1.9.6

AP1000 "COL Items" (Section 9.5.1.8, (Table 1.8-2) including "WA" Items in Table 9.5.1-1)	BTP CMEB 9.5-1 Section	Text Reference
annually to verify that automatic hold-open, release, and closing mechanisms and latches are operable.		
51) Alternative means for verifying that fire doors protect the door opening as required in case of fire.	C.5.a(5)	9.5.1.9.8
52) The fire brigade leader should have ready access to keys for any locked fire doors	C.5.a(5)	9.5.1.9.2.1
56) Fire exit routes should be clearly marked.	C.5.a(7)	9.5.1.2.1.1
71) Water drainage from areas that may contain radioactivity should be collected, sampled and analyzed before discharge to the environment.	C.5.a(14)	9.5.1.9.5
80) Use of compressed gases in buildings should be controlled.	C.5.d(2)	9.5.1.9.4(7)
111) A portable radio communications system should be provided for use by the fire brigade and other operations personnel required to achieve safe plant shutdown.	C.5.g(4)	9.5.1.9.2
149) All valves in the fire protection system should be periodically checked to verify position	C.6.c(2)	9.5.1.9.6
157) Fire hoses should be hydrostatically tested in accordance with NFPA 1962. Hoses stored in outside hose houses should be tested annually. The interior standpipe hose should be tested every 3 years.	C.6.c(6)	9.5.1.9.6
174) Self contained breathing apparatus should be provided near the containment entrances for firefighting and damage control personnel. These units should be	C.7.a(2)	9.5.1.9.2.1

AP1000 "COL Items" (Section 9.5.1.8, (Table 1.8-2) including "WA" Items in Table 9.5.1-1)	BTP CMEB 9.5-1 Section	Text Reference
independent of any breathing apparatus provided for general plant activities.		
180) Breathing apparatus for main control room operators should be readily available	C.7.b	9.5.1.9.2.1
225) Cooling towers should be of non-combustible construction or so located and protected that a fire will not affect any safety related systems or equipment.	C.7.q	FSAR Appendix 9.5A (later)
228) Gas (acetylene-oxygen) cylinder storage locations should not be in areas that contain or expose safety-related systems or the fire protection systems that protect those systems.	C.8.a	9.5.1.9.4(7)
229) A permit system for use of acetylene-oxygen gases in safety related areas should be required.	C.8.a	9.5.1.9.4(7)
230) Unused ion exchange resins should not be stored in areas that contain or expose safety-related equipment.	C.8.b	9.5.1.9.4(1)
231) Hazardous chemicals should not be stored in areas that contain or expose safety-related equipment.	C.8.c	9.5.1.9.4(8)

9.5.1 Fire Protection System

The primary objectives of the AP1000 fire protection program are to prevent fires and to minimize the consequences should a fire occur. The program provides protection so that the plant can be shut down safely following a fire. The fire protection system (FPS) detects and suppresses fires, and is an integral part of the AP1000 fire protection program. The AP600 fire protection system was licensed as part of 10CFR52, Appendix C, AP600 Design Certification. Since AP1000 is very similar to AP600, the basis for the AP1000 fire protection system is that of AP600. The AP1000 compliance with BTP CMEB 9.5-1 is the same as for AP600.

9.5.1.1.1 Safety Design Basis

To achieve the required high degree of fire safety, and to satisfy fire protection objectives, the AP1000 is designed to:

- Prevent fire initiation by controlling, separating, and limiting the quantities of combustibles and sources of ignition
- Isolate combustible materials and limit the spread of fire by subdividing plant buildings into fire areas separated by fire barriers
- Separate redundant safe shutdown components and associated electrical divisions to preserve the capability to safely shut down the plant following a fire
- Provide the capability to safely shut down the plant using controls external to the main control room, should a fire require evacuation of the control room or damage the control room circuitry for safe shutdown systems
- Separate redundant trains of safety-related equipment used to mitigate the consequences of a design basis accident (but not required for safe shutdown following a fire) so that a fire within one train will not damage the redundant train
- Prevent smoke, hot gases, or fire suppressants from migrating from one fire area to another to the extent that they could adversely affect safe shutdown capabilities, including operator actions
- Provide confidence that failure or inadvertent operation of the fire protection system cannot prevent plant safety functions from being performed
- Preclude the loss of structural support, due to warping or distortion of building structural members caused by the heat from a fire, to the extent that such a failure could adversely affect safe shutdown capabilities
- Provide floor drains sized to remove expected firefighting water flow without flooding safety-related equipment
- Provide firefighting personnel access and life safety escape routes for each fire area
- Provide emergency lighting and communications to facilitate safe shutdown following a fire
- Minimize exposure to personnel and releases to the environment of radioactivity or hazardous chemicals as a result of a fire

The fire protection system is classified as a nonsafety-related, nonseismic system. Special seismic design requirements are applied to portions of the standpipe system located in areas containing equipment required for safe shutdown following a safe shutdown earthquake, as described in subsection 9.5.1.2.1.5. In addition, the containment isolation valves and associated piping for the fire protection system are safety-related (Safety Class 2) and seismic Category I. The fire protection system is not required to remain functional

following a plant accident or the most severe natural phenomena, except as indicated below for a safe shutdown earthquake.

The fire protection system is designed to perform the following functions:

- Detect and locate fires and provide operator indication of the location
- Provide the capability to extinguish fires in any plant area, to protect site personnel, limit fire damage, and enhance safe shutdown capabilities
- Supply fire suppression water at a flow rate and pressure sufficient to satisfy the demand of any automatic sprinkler system plus 500 gpm for fire hoses, for a minimum of 2 hours
- Maintain 100 percent of fire pump design capacity, assuming failure of the largest fire pump or the loss of offsite power
- Following a safe shutdown earthquake, provide water to hose stations for manual firefighting in areas containing safe shutdown equipment
- Satisfy the requirements of the passive containment cooling system as an alternate source of water to wet the containment dome or to refill the passive containment cooling water storage tank after a loss-of-coolant accident, if the fire protection system is available
- Provide an alternate supply of cooling water to the normal residual heat removal system heat exchanger after a loss of normal component cooling water system function.

9.5.1.1.2 Power Generation Design Basis

AP1000 fire prevention, control, detection, and suppression features provide plant and personnel safety. The fire protection analysis (see Appendix 9A) evaluates the adequacy of fire protection for systems and plant areas important to the generation of electricity.

9.5.1.1.3 Nonsafety-Related Containment Spray Function

The fire protection system provides a nonsafety-related containment spray function. This function is discussed in subsection 6.5.2.

9.5.1.2.1 General Description

The fire protection program and the design of the fire protection system conform to the applicable codes and standards listed in Section 3.2, and the following:

- 10 CFR 50.48, Fire Protection (Reference 15)
- General Design Criterion 3, Fire Protection (Reference 16)
- SECY-93-087, Section I.E., Fire Protection (Reference 17)

Table 9.5.1-1 is a point-by-point description of the conformance of the fire protection program with the guidelines of Branch Technical Position (BTP) CMEB 9.5-1 (Reference 1). AP1000 meets the enhanced fire protection provisions of SECY-93-087 as demonstrated in the fire protection analysis (Appendix 9A).

The plant includes features to minimize the likelihood that a fire will occur and to limit the spread of fire.

The fire protection system detects fires and provides the capability to extinguish them using fixed automatic and manual suppression systems, manual hose streams, and/or portable firefighting equipment. The fire protection system consists of a number of fire detection and suppression subsystems, referred to as systems, including:

- Detection systems for early detection and notification of a fire
- A water supply system including the fire pumps, yard main, and interior distribution piping
- Fixed automatic fire suppression systems
- Manual fire suppression systems and equipment, including hydrants, standpipes, hose stations and portable fire extinguishers

The fire detection and suppression systems are described later in this subsection.

9.5.1.2.1.1 Plant Fire Prevention and Control Features

Architectural and Structural Features

Plant buildings use noncombustible structural materials, primarily reinforced concrete, gypsum, masonry block, structural steel, steel siding, and concrete/steel composite material. Fireproofing of structural steel is not normally required, but the effects of heat generated by a fire are considered in the design. Localized structural steel fireproofing is provided as required, based on a realistic analysis of the time-temperature fire effects on the structural members. Heat transfer analyses based on the postulated fire are used to determine whether the fire will heat the structural members to a specified critical temperature. Where structural failures could adversely affect safe shutdown capabilities, this analysis of the fire resistance of structural steel members establishes the need for fireproofing.

Firefighting personnel access routes and life safety escape routes are provided for each fire area. Fire exit routes are clearly marked.

Buildings outside primary containment generally have two enclosed stairways for emergency access. Stairwells serving as escape routes, access routes for firefighting, or access routes to areas containing equipment necessary for safe shutdown of the plant are equipped with emergency lighting. Such stairwells, and elevator shafts, which penetrate fire barrier floors, are enclosed in towers. The majority of the stairwell towers in the auxiliary building contain both concrete structural walls and nonstructural walls, consisting of a concrete/steel composite material having a fire resistance rating of at least 2 hours. These auxiliary building stairwells are protected from potential missiles by other structures or by the selection of the location of the stairwell remote from potential missile sources. Openings are protected with approved automatic or self-closing doors having a rating of 1.5 hours.

Some of the walls of the turbine building and annex building stairwell enclosures, which are exposed to the interior of the buildings, are also constructed with a concrete/steel composite material. However, the turbine building and annex building stairwell enclosure walls that face the yard area are constructed with an exterior siding common to the overall siding used for the turbine and annex buildings.

The main control room is designed to permit rapid detection and location of fires in the underfloor and ceiling spaces and allow ready access for manual firefighting. Due to the need to provide passive cooling capability into the main control room ceiling, it will not be protected against fires from within the main control room. The ceiling will be a fire barrier from fires in the room above the main control room.

Plant Arrangement

The plant is subdivided into fire areas to isolate potential fires and minimize the risk of the spread of fire and the resultant consequential damage from corrosive gases, fire suppression agents, smoke, and radioactive contamination.

Some fire areas are subdivided into fire zones to permit more precise identification of the type and locations of combustible materials, fire detection, and suppression systems. The

subdivision into fire zones is based on the configuration of interior walls and floor slabs, and the location of major equipment within each fire area.

Fire barriers are provided in accordance with BTP CMEB 9.5-1. Three-hour fire barriers are non-combustible and surround fire areas containing safety-related components. The resistance of fire barriers in nonsafety-related areas of the plant may be less than 3 hours, where justified by the fire protection analysis (Appendix 9A).

Three-hour fire barriers provide complete separation of redundant safe shutdown components, including equipment, electrical cables, instrumentation and controls, except where the need for physical separation conflicts with other important requirements, specifically:

- Fire barrier separation is not provided within the main control room fire area because functional requirements make such separation impractical. The risk of fires in the control room is minimized by the reduction in the quantity of electrical cables. Continuous occupancy provides confidence that fires would be quickly detected and suppressed. Should a fire require evacuation of the main control room, the plant can be safely shut down using independent controls at the remote shutdown workstation, located in a separate fire area.

- Fire barrier separation is not provided between the main control room and the room above it from fires in the main control room. There are no safe shutdown components in the room above. There is fire barrier separation between the main control room and the room above it for fires in the room above.

- Fire barrier separation is not provided within the remote shutdown room fire area because the remote shutdown workstation is not required for safe shutdown unless a fire requires evacuation of the main control room.

- Complete fire barrier separation necessary to define a fire area is not provided throughout the primary containment fire area (including the middle and upper annulus zones of the shield building) because of the need to satisfy other design requirements, such as allowing for pressure equalization within the containment following a high-energy line break. Fire protection features and equipment arrangement which define fire zones within the containment fire area provide confidence that at least one train of safe shutdown equipment will remain undamaged following a fire in any fire zone. The quantity of combustible materials is minimized. The use of canned reactor coolant pump motors has eliminated the need for an oil lubrication system. Redundant trains of safe shutdown components are separated whenever possible by existing structural walls, or by distance. Selected cables of a safety-related division which pass through a fire zone of an unrelated division are protected by fire barriers. The fire protection system provides appropriate fire detection and suppression capabilities.

Outside of the primary containment and the main control room, the arrangement of plant equipment and routing of cable are such that safe shutdown can be achieved with all components (except those protected by 3-hour fire barriers) in any one fire area rendered inoperable by fire.

Openings and penetrations through fire barriers are protected in accordance with the guidelines of BTP CMEB 9.5-1.

The fire protection analysis contains a description of plant fire areas, fire zones, fire barriers, and the protection of fire barrier openings, as well as a description of the separation between redundant safe shutdown components.

Electrical Cable Design, Routing, and Separation

Electrical cable (including fiber optic cable) and methods of raceway construction are selected in accordance with BTP CMEB 9.5-1. Metal cable trays are used. Rigid metal conduit or metal raceways are used for cable runs not embedded in concrete or buried underground. Flexible metallic tubing is used in short lengths for equipment connections.

The insulating and jacketing material for electrical cables are selected to meet the fire and flame test requirements of IEEE Standard 1202 (Reference 18) or IEEE Standard 383 (Reference 3) excluding the option to use flame source, oil, or burlap.

The design, routing, and separation of cable and raceways are further described in Section 8.3.

Control of Combustible Materials

The plant is constructed of noncombustible materials to the extent practicable. The selection of construction materials and the control of combustible materials are in accordance with BTP CMEB 9.5-1 and Section 3.3 of NFPA 804 (Reference 2) as specified in WCAP-15871 (Reference 20).

The storage and use of hydrogen are according to NFPA 50A and NFPA 50B (Reference 2). Hydrogen lines in safety-related areas are designed to seismic Category I requirements.

Ventilation systems are designed to maintain the hydrogen concentration in the battery rooms well below 2 percent by volume, as described in subsections 9.4.1 and 9.4.2.

The turbine lubrication oil system, located in the turbine building, is separated from areas containing safety-related equipment by 3-hour rated fire barriers.

Outdoor oil-filled transformers are separated from plant buildings according to NFPA 804 (Reference 2).

The diesel fuel oil storage tanks and the diesel fuel oil transfer pump enclosure are located in the yard area more than 50 feet from any safety-related structure. Potential oil spills from the storage tanks are confined by a diked enclosure. A diesel generator fuel day tank is located within each diesel generator room and is enclosed in a 3-hour fire rated barrier.

The diesel fuel supply for the ancillary diesel generators is in the same room as the diesel generators. The ancillary diesel generator room is separated from the rest of the annex building by a 3-hour rated fire barrier.

The diesel fuel supply for the diesel-driven fire pump is in the diesel-driven fire pump enclosure. The diesel pump enclosure is located in the yard more than 50 feet from safety-related structures. The enclosure includes a fire detector which produces an audible alarm locally with both visual and audible alarms in the main control room and security central alarm station. The fire is extinguished by operation of an automatic sprinkler system or manually, using hose streams or portable extinguishers.

Quantities and locations of other combustible materials are identified in the fire protection analysis (see Appendix 9A).

Control of Radioactive Materials

As described in the fire protection analysis, materials that collect or contain radioactivity, such as spent ion exchange resins and filters, are protected and stored in accordance with BTP CMEB 9.5-1.

9.5.1.2.1.2 Fire Detection and Alarm Systems

Fire detection and alarm systems are provided where required by the fire protection analysis, in accordance with BTP CMEB 9.5-1 and NFPA 72 (Reference 2). Fire detection and alarm systems are generally in accordance with NFPA 804 (Reference 2). See WCAP-15871 (Reference 20) for details.

Fire detectors respond to smoke, flame, heat, or the products of combustion. The installation of fire detectors is in accordance with NFPA 72 (Reference 2) and the manufacturer's recommendations. The selection and installation of fire detectors is also based on consideration of the type of hazard, combustible loading, the type of combustion products, and detector response characteristics. The types of detectors used in each fire area are identified in the fire protection analysis.

The fire detection system provides audible and visual alarms and system trouble annunciation in the main control room and the security central alarm station. Annunciation circuits connecting zone, main, and remote annunciation panels are electrically supervised.

Each fire detection, indicating, and alarm unit is provided with reliable ac electrical power from the non-Class 1E uninterruptible power supply system. This system is described in subsection 8.3.2.1.2.

9.5.1.2.1.3 Fire Water Supply System

The fire water supply system is designed in accordance with BTP CMEB 9.5-1 and the applicable NFPA standards.

Fire water is supplied from two separate fresh water storage tanks. The primary fire water tank is dedicated to the fire protection system. The secondary fire water tank serves the raw water system but contains water for use by the fire protection system and the containment spray system.

There are two 100-percent capacity fire pumps. The lead pump is electric motor-driven and the secondary pump is diesel engine-driven. A motor-driven jockey pump is used to keep the fire water system full of water and pressurized, as required. For additional information regarding the fire water tanks and pumps, see subsection 9.5.1.2.3.

The fire water tanks are permanently connected to the fire pumps suction piping and are arranged so that the pumps can take suction from either or both tanks. Piping between the fire water sources and the fire pumps is in accordance with NFPA 20 (Reference 2). A failure in one tank or its piping cannot cause both tanks to drain.

Fire protection water is distributed by an underground yard main loop, designed in accordance with NFPA 24 (Reference 2). The yard main includes a building interior header that distributes water to suppression systems within the main plant buildings. Indicator valves provide sectionalized control and permit isolation of portions of the yard main for maintenance or repair. An indicator valve also separates the individual fire pump connections to the main.

Sprinkler and standpipe systems are supplied by connections from the yard main. Where plant areas, other than the containment and outlying buildings, are protected by both sprinkler systems and standpipe systems, the connections from the yard main are arranged so that a single active failure or a crack in a moderate energy line cannot impair both systems.

Manual valves for sectionalized control of the yard main or for shutoff of the water supply to suppression systems are electrically supervised if located above ground and administratively controlled if located underground.

Hydrants are provided on the yard main in accordance with NFPA 24 (Reference 2), at intervals of up to about 250 feet. They provide hose stream protection for every part of each building and two hose streams for every part of the interior of each building not covered by standpipe protection, excluding certain remote areas of the shield building. The lateral to each hydrant is controlled by an isolation valve.

Hose houses are in accordance with NFPA 24 (Reference 2). They are located at intervals of not more than 1000 feet along the yard main.

Outdoor fire water piping and water suppression systems located in unheated areas of the plant are protected from freezing.

A permanent connection between the fire protection system and the component cooling water system in the annex building is normally isolated by two valves in series.

A permanent connection between the fire protection system and the containment spray system in the containment is normally isolated by two valves in series.

9.5.1.2.1.4 Automatic Fire Suppression Systems

Automatic fire suppression systems are in accordance with BTP CMEB 9.5-1 and the applicable NFPA standards, with consideration of the unique aspects of each application, including building characteristics, materials of construction, environmental conditions, fire area contents, and adjacent structures.

Fixed automatic fire suppression systems are provided based on the results of the fire protection analysis.

The selection of automatic suppression systems for each plant area is based on the guidance of NFPA 804 (Reference 2) as stated in WCAP-15871 (Reference 20). Water systems are preferred, but the use of automatic water suppression systems for firefighting in radiation areas is minimized because of the possible spread of contamination. Halon and carbon dioxide fixed flooding systems are not used.

The fire protection analysis describes the fire suppression systems provided for each fire area.

Automatic Water Suppression Systems

Automatic sprinkler and water spray systems are provided in accordance with the applicable requirements of NFPA 13 and NFPA 15 (Reference 2). Each system consists of overhead piping and components from a water supply valve to the point where water discharges from the system. Some systems have a control valve that is actuated automatically by the fire detection system. Each system has a status monitoring device for actuating an alarm when the system is in operation.

Preaction sprinkler systems are used where the leakage or inadvertent actuation of water-filled sprinkler systems could produce undesirable consequences, such as water discharge on equipment important to continued plant operation.

Each type of automatic sprinkler and automatic water spray system used on AP1000 is briefly described below:

- **Wet Pipe** - A sprinkler system employing closed (fusible link operated) sprinklers attached to a water-filled piping network. Water discharges immediately from those sprinklers where the heat from a fire is sufficient to melt the fusible link. System operation is terminated manually by shutting the water-supply valve.

- **Dry Pipe** - A sprinkler system employing closed sprinklers attached to a piping network containing pressurized air. Heat from a fire opens one or more sprinklers, releasing the air and permitting water supply pressure to open the dry pipe valve. Water flows into the piping network and discharges from the open sprinklers. System operation is terminated manually by shutting the water-supply valve.

- **Preaction** - A sprinkler system employing closed sprinklers attached to a dry piping network, with fire detector(s) installed in the same areas as the sprinklers. Operation of the fire detection system opens a preaction valve, which permits water to flow into the sprinkler piping network and to be discharged from any sprinklers that may

have been opened by the fire. System operation is terminated manually by shutting the water-supply valve.

- **Deluge Sprinkler or Water Spray System** - A system employing open sprinklers or spray nozzles attached to a dry piping network, with fire detector(s) installed in the same areas as the sprinklers. Operation of the fire detection system opens a deluge valve, which permits water to flow into the sprinkler piping network and to be discharged from all the sprinklers or spray nozzles. System operation is terminated manually by shutting the water-supply valve.

9.5.1.2.1.5 Manual Fire Suppression Systems

Manual fire suppression capability is provided in areas that do not require an automatic suppression system. Plant areas that have an automatic suppression system also have manual backup fire suppression capability.

Manual fire suppression capabilities include the yard main fire hydrants and hose stations described in subsection 9.5.1.2.1.3.

Standpipe and Hose Systems

Standpipe systems are provided for each building in accordance with NFPA 14 (Reference 2) requirements for Class III service. Wet standpipe systems are used except inside containment. Individual standpipes are at least 4 inches in diameter for multiple hose connections and 2.5 inches in diameter for single hose connections.

Hose stations are located to facilitate access for firefighting, as described in the fire protection analysis. Areas that contain, or could present a fire exposure event to, safety-related equipment are within reach of at least one effective hose stream. Alternative hose stations are provided for an area where the fire could block access to a single hose station serving that area. To the maximum extent practical, hose stations are located outside of high-radiation areas.

Each hose station has not more than 100 feet of 1.5-inch woven-jacket lined fire hose. Nozzles are provided at each station.

Seismic Standpipe System

The standpipe system serving areas containing equipment required for safe shutdown following a safe shutdown earthquake is designed and supported so that it can withstand the effects of a safe shutdown earthquake and remain functional. The seismically analyzed standpipe system is illustrated on Figure 9.5.1-1. This system also supplies water to automatic suppression systems inside containment and in the nonradiologically controlled portion of the auxiliary building (see Appendix 9A).

The seismic standpipe system is operated in the same manner during normal plant operation or following a safe shutdown earthquake. It is supplied with water from the safety related passive containment cooling system storage tank and normally operates independently of the rest of the fire protection system. The supply line draws water from a portion of the storage tank, using water allocated for fire protection. This volume of water is sufficient to supply two hose streams, each with a flow of 75 gallons per minute, for 2 hours.

The portion of the system outside containment is a wet standpipe system that is pressurized by the static head of water in the passive containment cooling system tank. The portion of the system inside containment is a dry standpipe system. The supply valve is normally closed for containment isolation. During shutdown periods when the containment is occupied, when operation of containment automatic suppression systems is required, or when containment access is required to fight a fire, the valve is opened to pressurize the system.

In the unlikely event that the water supply from the passive containment cooling system is unavailable or additional water is needed, the seismic standpipe system can be supplied from the fire main by opening the normally closed cross-connect valve with the plant fire main.

A passive containment cooling ancillary water storage tank is provided to supply the seismic standpipe system following a safe shutdown earthquake and after actuation of the passive containment cooling system. The tank is designed and supported so that it can withstand the effects of a safe shutdown earthquake and remain functional. A dedicated portion of the storage capacity of the tank is sufficient to supply two hose streams, each with a flow of 75 gallons per minute, for 2 hours. Normally much more water is available. (Refer to subsection 6.2.2 for additional information.)

A failure of the seismic standpipe system does not prevent successful operation of the passive containment cooling system. A leak in the standpipe system could result in the loss of only a limited amount of water from the passive containment cooling system storage tank, even if no action were taken to isolate the leak. The volume of water allocated for fire protection is not required for passive containment cooling.

Portable Fire Extinguishers

Portable fire extinguishers are provided throughout the plant. Portable extinguishers are readily accessible for use in high radiation areas but are not located within those areas unless the fire protection analysis indicates that a specific requirement exists.

9.5.1.2.2 System Operation

The fire protection system normally operates in an active standby mode. The fire water supply piping is kept full and pressurized by operation of the jockey pump. Shutoff valves controlling fire suppression systems are normally aligned in the open position. Fire detection and alarm circuits are normally energized and monitored for trouble or loss of power as described in subsection 9.5.1.2.1.2.

When a fire is detected, the fire detection system produces an audible alarm locally, and both visual and audible alarms in the main control room and security central alarm station.

Where the fire area is protected by an automatic suppression system, operation of the suppression system begins as described in subsection 9.5.1.2.1.4. Where the fire area is protected by manual suppression methods, the fire brigade reacts to control and extinguish the fire.

Ventilation system fire dampers close automatically against full airflow on high temperature to control the spread of fire and combustion products. Fire dampers serving certain safety-related, smoke-sensitive areas are also closed in response to an initiation signal from the fire detection system. Smoke is removed from the fire area as described in the fire protection analysis.

When water pressure in the yard main begins to fall, due to a demand for water from automatic or manual suppression systems, the motor-driven pump starts automatically on a low-pressure signal. If the motor-driven pump fails to start, the diesel-driven pump starts upon a lower pressure signal. The pump continues to run until it is stopped manually.

Firefighting activities continue until the fire is extinguished. Suppression systems are stopped manually. Operator actions are taken to repair and restore affected detection, alarm, and suppression systems to standby status.

9.5.1.2.3 Component Description

Selected fire protection system components are described below. Table 9.5.1-2 contains additional component data for fire protection equipment.

Fire Water Storage Tanks

Two separate fresh water storage tanks are provided for fire protection in accordance with NFPA 22 (Reference 2). The storage capacity of each tank is sufficient to maintain the design fire pump flow rate for at least 2 hours. Either tank can be automatically refilled from the raw water system within 8 hours. Freeze protection is provided as needed using electric immersion heaters.

Passive Containment Cooling Ancillary Water Storage Tank

See subsection 6.2.2.2.3 for a description of this component.

Fire Pumps

Two 100-percent capacity fire pumps are provided in accordance with NFPA 20 (Reference 2). Each pump is rated for 2000 gpm. The lead pump is electric motor-driven and the second pump is diesel engine-driven. The pumps and their controllers are UL-listed. Fire pump status alarms are provided in the main control room.

The motor-driven fire pump is supplied with power from the turbine building 480 Vac non-Class 1E switchgear. The fuel tank for the diesel-driven pump holds enough fuel to operate the pump for at least 8 hours.

Valves

Valves used in the fire protection system are of an approved type for fire protection service. See the Fire Protection Handbook (Reference 4) for typical descriptions of these valves.

Fire Detectors

The types of fire detectors used in specific applications are identified in the fire protection analysis. See Reference 4 for descriptions of these fire detectors and their principles of operation.

9.5.1.3 Safety Evaluation (Fire Protection Analysis)

The fire protection analysis evaluates the potential for occurrence of fires within the plant and describes how fires are detected and suppressed. It also confirms that the plant can be safely shut down following a postulated fire. The fire protection analysis is in Appendix 9A.

The fire protection analysis includes a set of fire area drawings and a discussion of the analysis methodology. It also provides the following information for each fire area in the plant:

- A description of the fire area and its fire barriers, its associated fire zones, as well as fire detection and suppression capabilities
- Identification of the type, quantity, and location of in-situ and anticipated transient combustible materials, and combustible loading
- A listing of safety-related mechanical and electrical equipment
- Fire severity category and equivalent duration
- An evaluation of fire protection system adequacy and the consequences of a fire, including a discussion of the control and removal of smoke and hot gases, and drainage system adequacy.

For fire areas containing safety-related structures, systems, and components the following information is also provided:

- An evaluation of fire protection system integrity. This includes a determination of whether the credible failure of a fire protection system component could cause inadvertent operation of an automatic fire suppression system in the fire area, and the resulting consequences. Also included is verification that no potential single impairment of the fire protection system could incapacitate both the automatic suppression system and the backup manual suppression system (generally a hose station), for fire areas where both types of suppression systems are provided.
- A safe shutdown evaluation confirming the capability to safely shut down the reactor and maintain it in a safe shutdown condition following a fire

The safe shutdown evaluation is based upon all components in a single fire area outside containment or any fire zone inside containment being disabled by the fire. Success is based upon the plant being able to achieve safe shutdown as discussed in Section 7.4. Safe shutdown is a safe, stable condition that can be maintained indefinitely with the reactor subcritical and reactor coolant pressure at a small fraction of its design pressure. As described in Section 7.4.1.1, safety-related systems achieve this condition automatically using reliable, passive processes. The passive residual heat removal heat exchanger transfers heat to the in-containment refueling water storage tank. Steam from this tank enters the containment which is cooled by the passive containment cooling system. These systems reduce the reactor temperature and pressure to less than 420°F and 600 psia in 36 hours. See Appendix 19E for additional details about the shutdown

evaluation. This is a safe and acceptable end state which is used to show compliance with BTP 9.5-1. The safe shutdown fire evaluation in Appendix 9A shows that there is sufficient safety-related equipment available after a fire which destroys a single fire area outside containment or any fire zone inside containment, to bring the plant to this safe shutdown condition.

It should be noted that following most fires, that nonsafety-related systems are expected to be available to bring the plant to a cold shutdown for repairs. These systems are defense in depth systems with redundant active components. These systems are expected to be available because of the use of redundant equipment and fire protection features, including separation or automatic fire suppression.

Table 9.5.1-4 lists the system capabilities that are expected to be available following a fire to bring the plant to a cold shutdown. This list does not contain the nonsafety-related support systems that are not necessary to operate following a fire. For example, chilled water cooling and non-1E instrumentation are not required following a fire. Heating and ventilation are not required except for two fans used to ventilate the non-1E switchgear rooms. The following safety-related capabilities are used together with these nonsafety-related capabilities to achieve cold shutdown:

- Insertion of control rods to provide reactor shutdown,
- Instrumentation to monitor reactor coolant system conditions,
- Operation of one core makeup tank in a natural circulation mode to provide reactor coolant makeup and boration in case the chemical and volume control system makeup is unavailable due to a fire,
- Manual partial opening (and closing) of one first stage automatic depressurization valve to provide a controlled, limited depressurization of the reactor coolant system to allow initiation of the normal residual heat removal system in case the chemical and volume control system auxiliary spray is unavailable due to a fire.

The use of these safety-related capabilities does not result in significant plant transients. The reactor coolant system pressure boundary is maintained and containment pressure and temperature conditions are not affected by the use of these safety-related capabilities.

If a less likely, more severe fire occurs, these systems are expected to be recovered after reasonable actions are taken to utilize temporary connections or to perform repairs (see subsections 9.2.2.4.5.5 and 9.5.1.1.1). Recovery of these systems allows the plant to be brought to a cold shutdown for plant repairs. No credit is taken in the Appendix 9A fire evaluation for nonsafety-related systems. As a result, fire separation is not required for these systems.

9.5.1.4 Testing and Inspection

The fire pumps are initially tested by the manufacturer in accordance with NFPA 20 (Reference 2) to verify pressure integrity and performance.

Preoperational testing is in accordance with the Initial Test Program (Chapter 14).

9.5.1.5 Instrumentation Applications

Pressure sensors start the fire pumps on decreasing fire main water pressure. Pressure indicators confirm adequate pressures for automatic and manual suppression systems. Valve position sensors are used to monitor the positions of water supply valves.

Temperature instrumentation is used to monitor fire water storage tank temperature. Level instrumentation is used to monitor levels in the fire water storage tanks and the diesel-driven fire pump fuel storage tank.

9.5.1.6 Personnel Qualification and Training

Preparation and review of the fire protection analysis, and design and selection of fire protection equipment, is performed by fire protection and nuclear safety systems engineers.

The qualification requirements for individuals responsible for development of the fire protection program, training of firefighting personnel, as well as associated administrative procedures, is the responsibility of the Combined License applicant.

9.5.1.7 Quality Assurance

Quality assurance controls are applied to the activities involved in the design, procurement, installation, testing, and maintenance of fire protection systems for safety-related areas, in accordance with the programs outlined in Chapter 17.

9.5.1.8 Combined License Information

The Combined License applicant will address qualification requirements for individuals responsible for development of the fire protection program, training of firefighting personnel, administrative procedures and controls governing the fire protection program during plant operation, and fire protection system maintenance.

The Combined License applicant will provide site-specific fire protection analysis information for the yard area, the administration building, and for other outlying buildings consistent with Appendix 9A.

The Combined License applicant will address BTP CMEB 9.5-1 issues identified in Table 9.5.1-1 by the acronym "WA."

The Combined License applicant will address updating the list of NFPA exceptions after design certification, if necessary.

The Combined License applicant will provide an analysis that demonstrates that operator actions which minimize the probability of the potential for spurious ADS actuation as a result of a fire can be accomplished within 30 minutes following detection of the fire and the procedure for the manual actuation of the valve to allow fire water to reach the automatic fire system in the containment maintenance floor.

The Combined License applicant will address the process for identifying deviations between the as-built installation of fire barriers and their tested configurations.

The Combined License applicant will establish procedures to minimize risk when fire areas are breached during maintenance. These procedures will address a fire watch for fire areas breached during maintenance.

The Combined License applicant will provide 2-hour fire resistance test data in accordance with ASTM E-119 and NFPA 251 for the composite material selected for stairwell fire barriers.